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May 3, 2001

VIA HAND DELIVERY **EX PARTE**

RECEIVED

MAY - 3 2001

FEDERAL COMMUNICATIONS COMMISSION
OFFICE OF THE SECRETARY

Ms. Magalie Roman Salas
Secretary
Federal Communications Commission
445 12th Street, S.W.
Washington, D.C. 20554

Re: **Ex Parte Communication in ET Docket No. 98-206; RM-9147; RM-9245; Applications of Broadwave USA et al., PDC Broadband Corporation, and Satellite Receivers, Ltd., to provide a fixed service in the 12.2-12.7 GHz Band; Requests of Broadwave USA et al. (DA 99-494), PDC Broadband Corporation (DA 00-1841), and Satellite Receivers, Ltd. (DA 00-2134) for Waiver of Part 101 Rules.**

Dear Ms. Salas:

On May 1, 2001, Sophia Collier and Antoinette Cook Bush of Northpoint Technology, Ltd. ("Northpoint") met with Commissioner Gloria Tristani and Adam Krinsky, Legal Advisor to the Commissioner. The purpose of this meeting was to discuss (1) the various technical issues raised in the in comments and reply comments filed by Northpoint in ET Docket 98-206 and (2) the report on spectrum sharing in the 12.2-12.7 GHz frequency band recently submitted by the MITRE Corporation. Northpoint urged the Commission to grant the pending license applications of its Broadwave USA affiliates, in view of the MITRE report's confirmation that Northpoint's technology can operate in the 12.2-12.7 GHz band without causing harmful interference to DBS operations. The attached handout was distributed at the meeting.

Eighteen copies of this letter are enclosed – two for inclusion in each of the above-referenced files. Please contact me if you have any questions.

Yours sincerely,

JC Rozendaal

J.C. Rozendaal

cc: Commissioner Gloria Tristani
Mr. Adam Krinsky

No. of Copies rec'd 0+18
List A B C D E

CERTIFICATE OF SERVICE

I, Shannon Thrash, hereby certify that on this 3rd day of May, 2001, copies of the foregoing were served by hand delivery* and/or first class United States mail, postage prepaid, on the following:

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Secretary
Federal Communications Commission
445 12th Street, S.W.
Room TW-B204
Washington, D.C. 20554

Commissioner Gloria Tristani*
Federal Communications Commission
445 12th Street, S.W.
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Shannon Thrash

Shannon Thrash
Legal Assistant

Broadwave SA™
Creating Cable Competition with Northpoint Technology

400 North Capitol, Suite 368
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April 30, 2001

Dear Member of Congress:

As you may recall, last year Congress mandated that the FCC select an independent entity to test the specific technology to be offered by any entity that had filed an application to share the 12-GHz band with the direct broadcast satellite industry. Northpoint was the only company to submit equipment for this congressionally-mandated test.

The FCC contracted MITRE Corp. to perform the test, and the FCC released MITRE's report on April 23, 2001. Since then the DBS industry has severely misrepresented the report's contents and conclusions. The most egregious assertion is that MITRE concluded *Northpoint's* patented system poses a significant threat of interference.

In fact, the MITRE report actually concluded that terrestrial services could share the 12 GHz band with satellites – provided that specialized sharing technology is used. MITRE specifically concluded that the techniques comprising the Northpoint technology were "effective" at mitigating interference. Furthermore, MITRE recommended a "process for licensing" terrestrial services by requiring the use of enabling technologies, which Northpoint has developed.

To comprehensively address the reckless and unfounded allegations of the DBS industry, we have assembled the attached packet for your review. Northpoint has been working for seven years at the FCC to gain the opportunity to offer our service to the public. With the MITRE report it should be clear that Northpoint technology is ready to go.

We also wish to note that the MITRE report provides strong evidence to support a conclusion that an auction is inappropriate for terrestrial use of the 12 GHz band. This view is shared by Northpoint and scores of others who have filed comments at the FCC, including broadcasters and consumer and minority advocacy groups. While Northpoint has demonstrated that its patented technology can share spectrum without causing harmful interference to DBS, no other party has made this showing. MITRE made clear that without specialized sharing technology like Northpoint, harmful interference can result. No amount of auction proceeds should be worth this risk or the delay of needed services to the public.

We realize the attached packet is rather thick but we think it is worth delving into if you have an interest in this topic. As always, we at Northpoint would welcome the opportunity to visit with you in person or by phone to answer any questions you might have.

Thank you for your attention,

Sincerely,

Sophia Collier
President & CEO

George "Chip" Tangen
Vice President, Legislative Affairs

NORTHPOINT TECHNOLOGY

REFUTES DBS INDUSTRY'S FALSE CLAIMS

REGARDING MITRE REPORT

Contents:

Tab	Item
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2	Full Text of MITRE Executive Summary (with Northpoint Annotations)
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4	Press Coverage: TR Daily New York Times
5	Northpoint and Terrestrial Sharing Supporters
6	Northpoint Patents 1994 – 2001
7	FCC Press Release Establishing Terrestrial Sharing

1

Satellite Broadcasting and Communications Association

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NEWS RELEASE

SBCA GROSSLY MISREPRESENTS THE MITRE REPORT:

NOWHERE DOES MITRE SAY THAT NORTHPOINT POSES THE RISK CLAIMED BY SBCA.

MITRE actually found that satellite terrestrial sharing is "feasible" when "mitigation techniques," such as those demonstrated by Northpoint, are used.

The MITRE report concludes by recommending a "process for licensing" the new services.

CONGRESSIONALLY-MANDATED INDEPENDENT TEST CONFIRMS NORTHPOINT'S PROPOSED SYSTEM "POSES A SIGNIFICANT INTERFERENCE THREAT TO DBS"

–MITRE Results Validate Satellite TV Providers' Tests That Demonstrated Harmful Interference To DBS Signals–

ALEXANDRIA, VA, April 24, 2001 – The Satellite Broadcasting and Communications Association (SBCA), DIRECTV, Inc. and EchoStar Communications welcome the report submitted to the Federal Communications Commission by the MITRE Corporation that concludes that Northpoint's proposed terrestrial service "poses a significant interference threat" to direct broadcast satellite (DBS) subscribers' television service if Northpoint were permitted to operate in the DBS Band.

"MITRE's findings confirm the results of tests conducted by DIRECTV and EchoStar of Northpoint transmissions. Those tests also showed that DBS customers would suffer harmful interference if a terrestrial system such as Northpoint is permitted to operate in the DBS spectrum band," said SBCA President Chuck Hewitt. "The satellite TV providers and the SBCA have claimed from the outset that Northpoint's proposed terrestrial service would cause harmful interference to DBS signals, and the independent tests conducted by MITRE have unequivocally validated our conclusion."

Interference such as that identified in the MITRE tests cannot be mitigated as a simple matter. "The consumer mitigation techniques suggested in the MITRE report are egregious, and far too burdensome for any consumer who is happily enjoying DBS service," added Hewitt. "Spectrum sharing should not occur simply for the sake of sharing, especially if consumers and competition are forced to pay the ultimate price."

- more -

The FCC has a statutory obligation to protect the DBS providers, which are the primary users of the frequency band, from harmful interference. The only way to ensure that 15 million plus DBS households served by DIRECTV and EchoStar – equaling over 40 million viewers -- are protected from interruption of their TV service is to continue the FCC's long-standing policy of keeping the DBS spectrum free of terrestrial users. The FCC has set aside spectrum other than the DBS spectrum specifically for use by "wireless cable" services like the one being proposed by Northpoint. Their system would be better suited for that spectrum, thus negating the need for spectrum sharing in the DBS frequency band.

"We have always said, and as the MITRE test results underscore, that this dispute is about interference not competition," concluded Hewitt. "If Northpoint will operate its wireless cable system in spectrum the FCC has set aside for that purpose, and not interfere with our customers, we will welcome the competition."

If the FCC permits Northpoint to share the DBS band, it will be jeopardizing the competition that has been created since DBS' entry into the multichannel video market. In light of the MITRE test results, the SBCA and the satellite TV providers again urge the FCC to reject Northpoint's plan to operate its proposed terrestrial service in the DBS band.

The Satellite Broadcasting and Communications Association of America (SBCA) is the national trade organization representing all segments of the satellite industry. It is committed to expanding the utilization of satellite technology for the broadcast delivery of video, data, voice, interactive and broadband services. The SBCA is composed of DBS, broadband, and other satellite service providers, programmers, equipment manufacturers, distributors, retailers, encryption vendors, and national and regional distribution companies.

###

Northpoint will place its transmit antennas so as to avoid harmful interference to ***any*** DBS customers.

Sprint and WorldCom have acquired virtually all "wireless cable" spectrum, thereby eliminating its availability in the United States.

DBS has failed to become an effective competitor to cable: prices remain high and DBS still cannot provide more than a few local channels and only in the top markets..

Northpoint will offer meaningful price competition; carry all local channels plus national cable channels; and provide high-speed Internet access – ***finally, a truly effective competitor to cable!***

(It's no wonder why they want to stop us.)

MITIGATION FACTS:
Effective Mitigation Occurs at the Transmitter

The DBS industry suggests that 15 million DBS subscribers will be required to undertake "egregious" and "burdensome" mitigation measures to avoid interference from Northpoint. This inflammatory claim is utterly and unequivocally untrue.

As the MITRE report makes clear, mitigation techniques performed at the transmitter – not at consumers' homes – can work to effectively eliminate interference.

Top mitigation techniques listed by MITRE include:

- Controlling ***transmitter*** power
- Controlling ***transmitter*** antenna height
- Controlling ***transmitter*** antenna transmission direction
- Using multiple ***transmit*** antennas
- Using real time ***transmitter*** power control

All of these techniques represent core features of Northpoint's patented technology. Northpoint firmly believes that implementation of this array of mitigation techniques will completely eliminate the possibility of harmful interference to consumers.

However, in the highly unlikely event that some DBS customer did experience harmful interference, Northpoint would solve the problem at its own expense. The MITRE Corp. stated several mitigation techniques could be effective, such as moving the dish's location, using a small 7" aluminum disc as a shield, or upgrading the quality of the DBS reception antenna. Not one of these measures can be construed as "egregious" or "burdensome" to the small number of consumers that might be affected:

2

Northpoint Technology

Annotated Version of
MITRE Technical Report – Abstract and Executive Summary

Analysis of Potential MVDDS Interference to
DBS in the 12.2-12.7 GHz Band

April 25, 2001

MTR 01W0000024

MITRE TECHNICAL REPORT

Analysis of Potential MVDDS Interference to DBS in the 12.2–12.7 GHz Band

April 2001

MITRE

Bottomline:

MITRE recommends licensing of new service.

Abstract

The frequency band between 12.2 and 12.7 gigahertz (GHz) is allocated to Fixed and Broadcasting-Satellite radio services on a co-primary basis. In the United States, this band is widely used for direct broadcast satellite (DBS) services. Terrestrial radiocommunication services are also permitted, provided that these do not interfere with the satellite services. In 1999, Broadwave USA, a subsidiary of Northpoint Technologies, filed a petition with the Federal Communications Commission (FCC) seeking an authorization to operate terrestrial stations delivering Multichannel Video Distribution and Data Service (MVDDS) in the 12.2–12.7 GHz band. Since that time, numerous concerns have been raised about the extent and impact of potential interference of MVDDS transmissions on the existing DBS service. This report provides a thorough assessment of MVDDS interference into DBS receivers. It is based on a comprehensive analysis that included extensive laboratory and field measurements. The analysis also made use of modeling and simulation techniques to validate published and measured performance results. Special attention was given to the degradation of system availability in the presence of rain losses. The report also discusses possible interference-mitigation approaches, recommends a process for licensing MVDDS transmitters, and addresses key policy issues.

KEYWORDS: Spectrum sharing, MVDDS, DBS, interference, broadcast satellite, EchoStar, DIRECTV, Dish TV, Northpoint, video quality.

Text boxes indicate Northpoint comments.
Emphasis added by Northpoint.

Executive Summary

The frequency band between 12.2 and 12.7 gigahertz (GHz) is allocated to the Fixed and Broadcasting-Satellite radio services on a co-primary basis. International Telecommunications Union (ITU) Footnote S5.490 permits the operation of stations that provide "terrestrial radiocommunication services" in the same band, subject to the restriction that they "shall not cause harmful interference to the space services operating in conformity with the broadcasting satellite Plan for Region 2 contained in Appendix S30." CFR 47, Part 100 codifies U.S. regulations for Direct Broadcast Satellite (DBS) service in this band.

In 1999, Broadwave USA, a subsidiary of Northpoint Technologies, Inc., filed a petition with the Federal Communications Commission (FCC) seeking an authorization to operate terrestrial stations delivering Multichannel Video Distribution and Data Service (MVDDS) in the 12.2–12.7 GHz band. Subsequently, two other companies, PDC Broadband Corporation and Satellite Receivers, Ltd. filed similar applications with the FCC.

The FCC issued a Notice of Proposed Rulemaking on 24 November 1998, and a First Report and Order (R&O) and a Further Notice of Proposed Rulemaking (NPRM) as ET Docket 98-206 on 8 December 2000. These documents address the issues associated with permitting MVDDS in the band, and conclude that sharing the band between MVDDS and DBS systems is possible, subject to certain precautions that must be taken to prevent interference to DBS systems.

MITRE Report had two goals:

1- Analyzing general issues of sharing between MVDDS and DBS

2- Demonstration of specific technologies of Northpoint, Pegasus and Satellite Receivers using equipment provided by the specific company.

The FCC's Fiscal Year (FY) 2001 budget authorization contains a requirement that the FCC select an independent engineering firm to perform an analysis to determine whether these two services can share the band without harmful interference to DBS systems. The FCC selected The MITRE Corporation to perform this work. The 19 January 2001 Statement of Work for the project says that "The objective of the tasks is to perform a technical demonstration or analysis of any terrestrial service technology proposed by any entity that has filed an application to provide terrestrial service in the direct broadcast satellite frequency band to determine whether the terrestrial service technology proposed to be provided by that entity will cause harmful interference to any direct broadcast satellite service."

MITRE's effort was divided into tasks in the following areas:

- Equipment measurements
- Satellite receiver simulation
- Propagation and rain-attenuation modeling
- Interference predictions

All measurements for the project were conducted at MITRE's laboratories in Bedford, Massachusetts. MITRE measured the radiation patterns of three DBS antennas and two MVDDS antennas in its anechoic chamber, which has been extensively used to make measurements of critical defense systems for several years. DBS receiver susceptibility to MVDDS interference was measured in the laboratory by connecting an MVDDS transmitter to a DBS receiver through an attenuator, and varying the MVDDS signal level to generate a set of susceptibility curves. The DBS receiver was operating with a live signal from the satellite at the time of these measurements. Limited field measurements of the MVDDS signal level at the terminals of the DBS antenna were also made for a variety of DBS antenna orientations. Appendix A contains a detailed description of measurement procedures.

MITRE's Fort Monmouth, New Jersey laboratory used the Signal Processing Workstation (SPW™) software package to model the DBS/MVDDS interference environment in order to provide an independent verification of the laboratory measurements. Runs were made for the combinations of code rate, interleaver length and Reed-Solomon error correction that are in use by DBS vendors. The simulations produced results that were consistent with those derived from the laboratory and field measurements. Details of the simulation can be found in Section 3.1.

The primary propagation mechanism of interest in this analysis is the attenuation of DBS signals by rain, which is the most significant variable in the computation of downlink availability. The amount of attenuation is a function of rain rate, which varies with geographic location. Section 2 provides a discussion of the rain model used in this analysis.

To quantify the effect that MVDDS systems would have on DBS reception, a model was developed that incorporates the measured and simulated susceptibility data, the rain attenuation statistics, and the equipment parameters of the two systems. This model was run for ten locations throughout the contiguous United States to assess the impact of MVDDS operations on DBS reception. The locations were selected to cover the full range of climatic regions and DBS elevation angles. The model produced plots showing areas where the interference-impact criterion (change in unavailability) was exceeded. From these plots, it was possible to determine the feasibility of MVDDS deployment in the band.

Conclusions

The analysis and testing performed by MITRE and described elsewhere in this report have demonstrated that:

"Generic" MVDDS can pose an interference threat.

- MVDDS sharing of the 12.2–12.7 GHz band currently reserved for DBS poses a significant interference threat to DBS operation in many realistic operational situations.

Interference can be reduced or eliminated by technology: "mitigation techniques."

- However, a wide variety of mitigation techniques exists that, if properly applied under appropriate circumstances, can greatly reduce, or eliminate, the geographical extent of the regions of potential MVDDS interference impact upon DBS.

- MVDDS/DBS bandsharing appears feasible if and only if suitable mitigation measures are applied. Different combinations of measures are likely to prove "best" for different locales and situations.

The question remains: do the potential costs of applying the necessary mitigatory measures, together with the impact of the residual MVDDS-to-DBS interference that might remain after applying such measures, outweigh the benefits that would accrue from allowing MVDDS to coexist with DBS in this band? To facilitate the FCC's decision, we have assessed the probable effectiveness of available mitigation techniques in reducing the potential impact and geographical extent of MVDDS interference upon DBS operations.

Techniques for preventing or reducing MVDDS interference in DBS receivers fall into three general categories:

- Selection of MVDDS operational parameters

- Possible MVDDS system-design changes

- Corrective measures at DBS receiver locations

Mitigatory techniques in each of these three categories are discussed in detail in Section 6.2. The most important operational parameters that can be adjusted to control interference in existing MVDDS system designs are transmitter power, frequency offset, tower height, elevation tilt, and azimuthal orientation.

Northpoint holds patent on this technique and demonstrated it to MITRE as shown in Appendix A.

- *Keeping MVDDS transmitter power as low as possible* without sacrificing coverage requirements is the most basic and obvious means for controlling interference to DBS.

Northpoint demonstrated second technique to MITRE, Appendix A.

- The use of a *7-MHz frequency offset* between the MVDDS and DBS carriers has been shown through MITRE's testing to reduce effective interference levels by 1.7 dB, and noticeably shrinks the areas in which DBS receivers are potentially affected by MVDDS interference.

Northpoint demonstrated this technique in its Washington DC test.

- *Increasing the MVDDS transmitting antenna height* reduces the sizes of the areas susceptible to a given level of interference. However, the simulations of pages B-11 through B-15 indicate that substantial benefits may not accrue unless the tower height is at least 100, or perhaps even 200, meters above the level of the DBS receiving antennas in the surrounding area.

This is a valuable method in some cases. Demonstrated to MITRE by Northpoint.

- *Adjusting the elevation tilt* of the MVDDS transmitting antenna may not be particularly effective. Tilting the antenna up 5 reduces the interference-impact area but shrinks the MVDDS coverage area in roughly the same proportion. This presumably means that more MVDDS towers (creating additional interference-impact areas) would be needed to cover a given geographical region than if the antennas had not been tilted.

Northpoint's patents cover the geometry described in this bullet.

- *Pointing the MVDDS transmitting antennas **away from** the satellites*, rather than toward them as generally envisioned, could have beneficial effects in many situations. These are indicated by the simulation results of pages B-21 and B-23 and by the outputs of several other simulations in which easterly and northerly MVDDS transmitter boresight azimuths were used. When the satellites are generally to the south and their elevation angle is reasonably high, as in Denver, dramatic improvements in interference protection appear possible when the MVDDS transmitting antenna points north. When satellite elevation angles are somewhat lower (as in Seattle) the geometry is somewhat less favorable, but north-pointing seems to yield significant benefits in all locales where it has been simulated. Further testing to validate this concept is recommended.

Potential MVDDS design changes that might reduce the interference impact on DBS downlinks include real-time power control, multiple narrow transmitting-antenna beams, the use of circular polarization, and increasing the size of MVDDS receiving antennas.

Northpoint owns patent on real time power control.

- *Real-time power control*, which would reduce MVDDS transmitter power as necessary to protect DBS downlinks from degradation during rain, has sometimes been proposed as a technique for controlling MVDDS-to-DBS interference.

Antenna arrays of this nature are anticipated in Northpoint patents.

- The use of *multiple MVDDS transmitting-antenna beams*, each having a much narrower azimuthal beamwidth than the existing sectoral horns, might provide much better flexibility than the present antenna design in directing the interference-impact regions away from areas containing DBS subscribers.

Northpoint patents cover polarization methods described.

- *Circularly polarized MVDDS transmitting antennas*, if they used the same system of alternate senses for adjacent channels that is employed by DBS, might pose a considerably smaller interference threat than the currently planned exclusive use of horizontal polarization, for reasons explained in Section 6.2.2.

Northpoint filing with FCC made in 1997 documented this technique.

- *Larger MVDDS receiving antennas*, recently suggested by Pegasus, would increase their achievable gains and hence the G/T ratios of MVDDS receivers. This in turn would allow an MVDDS system to cover an identical service area with a smaller output power and hence with smaller resultant interference-impact regions.

Corrective measures that can be applied at DBS receiver installations include relocation and retrofitting of existing DBS antennas, the use of alternative antenna designs, and the replacement of older DBS set-top boxes.

Northpoint has committed to move dishes at its own expense.

- *Relocation of DBS receiving* antennas to put nearby buildings between them and nearby MVDDS interferers, while still leaving desired satellites in view, is a well-known corrective measure that would undoubtedly be effective in many situations.

Northpoint demonstrated this technique to MITRE, see Appendix A.

- The use of absorptive or reflective *clip-on shielding for existing DBS antennas*, to block any direct lines of sight that might exist between their LNBs (antenna feeds) and potentially interfering MVDDS transmitting antennas, is a technique that worked quite well during MITRE's open-air testing.

Good ideas for some cases.

- *DBS receiving-antenna replacement* is a relatively expensive but potentially effective mitigatory technique. For example, the simulation of page B-30 has shown the potential benefits of using single-feed 24"x18" antennas instead of the more commonly used 18" dishes.

- *Replacement of older DBS set-top boxes* may prove to be a useful mitigation technique if more recent models are more resistant to in-band interference.

Recommendations

License process proposed.

If licensing of new MVDDS services is to be successful, while preventing significant interference to DBS services, a number of policy issues need to be considered and resolved. These resolutions naturally lead to a licensing and deployment process for new MVDDS services. In Section 6.3, MITRE recommends a procedure for coordinating MVDDS applications to minimize interference to DBS systems.

A number of additional policy issues should also be considered. These issues and questions are discussed below, along with MITRE's recommendation to the FCC.

Northpoint supports recommendation:

Yes

- Should future DBS customers be protected and for how long?
  Recommendation: Yes, future DBS customers should be protected for as long as the MVDDS transmitter operates. The MVDDS service provider would need to measure *C/I* values and provide mitigation solutions to these new customers in the interference-mitigation region.

Yes

- Test results and analyses have been based on known MVDDS waveforms. Should new waveforms be allowed?
  Recommendation: New waveforms create an unknown vulnerability. MITRE recommends that these not be licensed without further study.

Yes

- Should the evaluation of sharing consider any DBS satellite in the geostationary arc, or should only existing U.S. satellites be considered? What about new U.S. satellites?
  Recommendation: DBS receivers operating with new and different satellites could be at risk in unforeseen ways. MITRE recommends that any satellites not addressed in the current report be studied further.

__Text boxes indicate Northpoint comments.__
__Emphasis added by Northpoint.__

Northpoint supports recommendation:

Yes

- If changes and improvements are made to any DBS system waveform, how should this impact policy?
  Recommendation: Results in this report are based on specific systems with known parameters. MITRE recommends that any new DBS waveforms be subject to further study.

Yes

- Should DBS satellites with weak coverage be protected? If so, how weak can these be and at what level should they be protected? (See examples in Section 5.2.3 and elsewhere.) What is the maximum baseline and degraded unavailability that should be allowed?
  Recommendation: Only DBS satellites with baseline unavailabilities of 100 hours/year or less, when operating without MVDDS interference into a DBS antenna with *G/T* of 11.2 dB/K, should be protected. DBS receivers operating with satellites that do not meet this criterion should not be protected from MVDDS interference when operating with such satellites.

Yes

- How should the advent of new DBS antennas affect the policy for MVDDS licensing?
  Recommendation: DBS antennas with *G/T* performance below 11.2 dB/K could seriously degrade DBS availability in rain. If the MVDDS service provider opts to mitigate MVDDS interference with the use of a different antenna, the replacement antenna should have a *G/T* at least as great as that of the original antenna.

Unclear what recommendation means.

- Should other causes of unavailability (besides rain and MVDDS interference) be included in the total budget?
  Recommendation: Other sources of outage should be considered, if they are significant and if their effect is known and documented. Sun-transit outages are an example.

Northpoint will locate transmitters such that no customers are impacted. Support Recommendation

- MVDDS antenna backlobes can interfere with a DBS antenna main beam. This would typically occur close to the MVDDS transmitter, generally north of the antenna. <u>These regions are typically very small</u>. Should very small regions of interference be exempted because of their small size?
  Recommendation: These small regions should not be exempted. All regions of the interference-mitigation region should be considered, regardless of size.

Unclear how FCC would mandate - but Northpoint supports proactive mitigation.

- Should MVDDS mitigation be based solely on customer complaints?
  Recommendation: MITRE believes that DBS customers may not know what is causing a particular outage, or the reason for its duration. Consequently, mitigation should not await DBS customer complaints. MITRE believes that <u>mitigation should be done proactively</u>, regardless of the presence or absence of such complaints.

- How much time should the MVDDS service provider be allowed in order to implement mitigation to the DBS receivers?

Text boxes indicate Northpoint comments.
Emphasis added by Northpoint.

Northpoint supports this recommendation.

Recommendation: To the maximum extent possible, mitigation should be accomplished prior to a license being granted for MVDDS operation.

MITRE believes that with implementation of the licensing process described in Section 6.3 and the other policy recommendations outlined above, <u>spectrum sharing between DBS and MVDDS services in the 12.2–12.7 GHz band is feasible</u>. However, MITRE recognizes that it is the FCC that must ultimately resolve the various policy issues and the approach to licensing new MVDDS services.

NORTHPOINT SUMMARY

Sharing is feasible when you use Northpoint.

Other waveforms and systems have not been proven – these can pose significant interference risk.

No other company demonstrated technology.

NET, NET
LICENSE
NORTHPOINT.

3

Appendix A

MITRE SUCCESSFULLY DEMONSTRATES NORTHPOINT SYSTEM

Appendix A of the MITRE report documents MITRE's open-air field testing of the Northpoint system. Both DBS and Northpoint advocated open-air field testing as the required standard for compliance with the Congressional mandate. ***This test demonstrated that the Northpoint system successfully eliminates the interference that is possible with a generic MVDDS installation.***

Section A.8 – Application of Northpoint Mitigation Principles

Section A.8 of the MITRE report describes how a generic MVDDS installation could be mitigated by the application of Northpoint technology. In the generic setup, MITRE points the MVDDS transmit antenna in the same direction as satellite transmissions (i.e., from south to north), and uses no beam tilt. Thus, the initial setup employs no mitigation, and as a result, interference occurs.

At Northpoint engineers' instructions, MITRE applied Northpoint principles to this installation. Specifically, MITRE turned the Northpoint transmit antenna towards the east and tilted the beam of the antenna by five degrees. ***These adjustments completely eliminated the interference. Moreover, MITRE demonstrated that this Northpoint-modified configuration enabled them to increase the transmit power by up to 13 dB (i.e., a factor of 20) without causing DBS degradation.***

Excerpt from MITRE report:

> *A.8.3.1 MVDDS Antenna Azimuth and Elevation*
>
> During installation of the MVDDS transmit antenna on the roof of the MITRE facility in preparation for open range testing, one ad-hoc test was performed for the purpose of assessing the impact of MVDDS antenna azimuth and elevation on existing DBS installations.
>
> With the MVDDS antenna pointed due North and 0 degrees elevation, the transmit power of the antenna was raised to the point of interfering with the DBS installation used for the laboratory interference measurements discussed in the previous sections, (approximately 300 feet away). Turning the antenna due east, at 5 degrees elevation, the transmit power was raised by 13 dB prior to any degradation of the previous installation.
>
> While not intended to be a quantitative test, it is interesting to note that Northpoint engineers were able to predict and mitigate the impact of the MVDDS transmission on a nearby installation.

The full text of Appendix A follows.

Appendix A

Testing of DBS Set-Top Boxes in the Presence of Northpoint MVDDS Interference

A.1 Overview of Test Configuration for Receiver Degradation Measures

A simplified view of the test configuration used to study the impact of MVDDS interference on DBS systems is shown in Figure A-1. In general, a closed DBS link is perturbed via the insertion of additional interference signals.

Signal quality is monitored through observation of the picture and sound quality as observed through a television connected to a DBS set-top box. Signal quality, $C/(N+I)$ or carrier to noise plus interference ratio is calculated from data measured with an Agilent 8564E spectrum analyzer. An SAT9520 DBS installer's tool was also used to measure C/N during interference experimentation.

In order to have independent control of both the carrier-to-noise-plus-interference, and the noise-to-interference power ratios, addition of both Gaussian noise and Northpoint interference was necessary.

Specific details of the test set-up and procedures are discussed in the following sections.

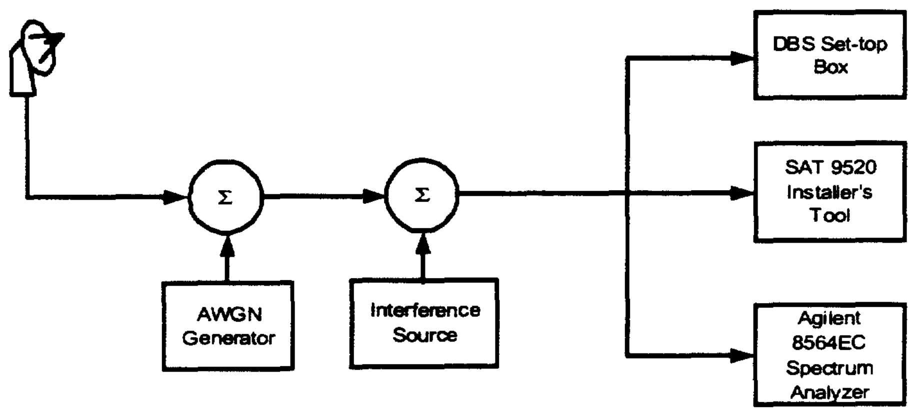

Figure A-1. Functional Overview of DBS Video Test Configuration

A.2 Details of the Test Configuration

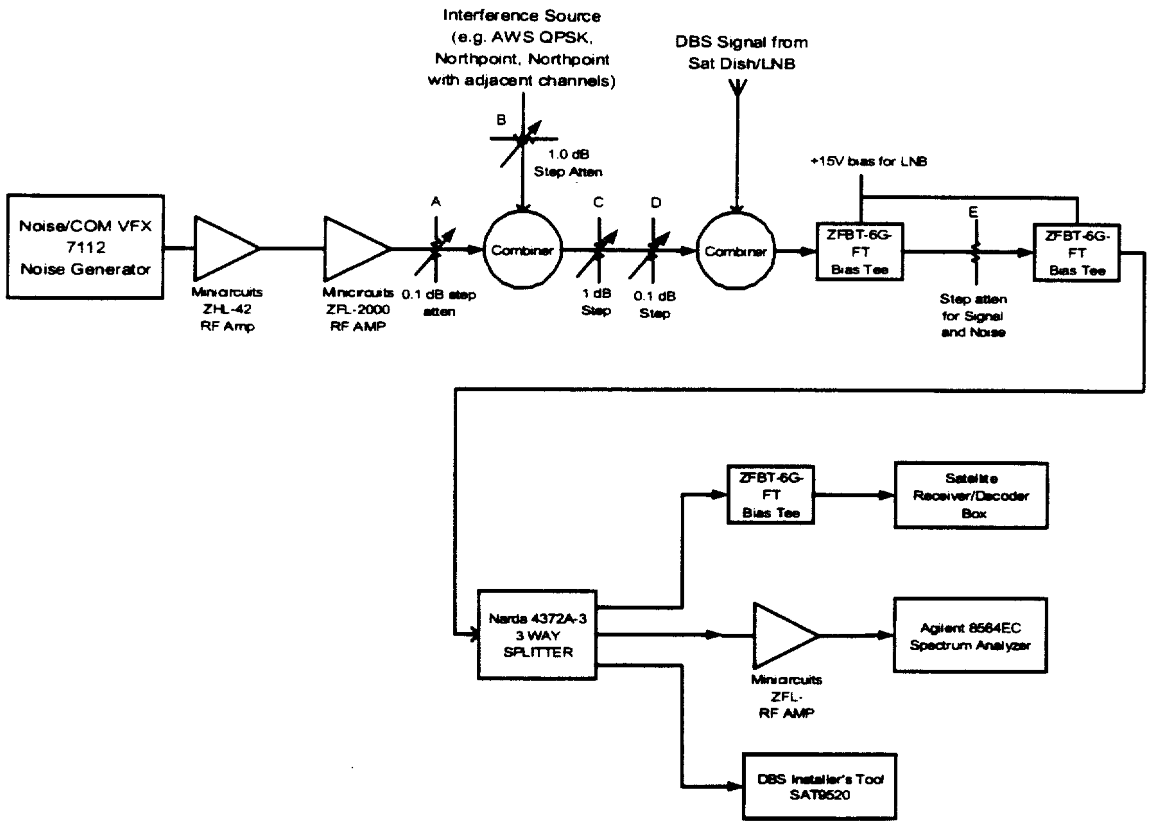

Figure A-2. Details of the Test Configuration for DBS Video Testing

Figure A-2 shows, in detail, the test configuration used to measure the impact of interference from MVDDS on DBS systems. A Noise/Com Model 7112 noise generator is amplified using two cascaded RF amplifiers, namely a Mini-circuits ZHL-42 and a Mini-circuits ZFL-2000, respectively. The amplified noise source level is controlled by both the 1 dB steps available on the noise generator, and the 0.1 dB step attenuator labeled "A" in Figure A-2. MVDDS interference is added to the noise using an Anzac H-8-4 combiner. Interference levels are controlled through step attenuator B. The power of the combined noise and interference is controlled using attenuators C and D and is then added to the DBS LNB video signal using another Anzac H-8-4 combiner. Attenuators C and D control the level of the composite noise and interference, *N+I*, relative to that of the DBS signal, C. A level of 15 volts bias is made available to the DBS receive satellite dish LNB by way of a ZFBT-6G-FT bias tee through the combiner. Attenuator "E" is used to control the composite DBS signal, interference, and noise level into the satellite decoder box. The composite signal is split three ways using a Narda 4372A-3 signal splitter. One output is fed to the satellite decoder box, a second is fed to an Agilent 8564EC spectrum analyzer, and a third to the SAT 9520 DBS Installer's Tool. The installer's tool monitors DBS signal quality, displaying signal strength, bit error rate, etc. A Mini-circuits ZFL-2000 RF amplifier is used to improve the noise performance of the spectrum analyzer.

A.2.1 Audiovisual (A/V) Signal Quality Determination

Due to the nature of the encoded DBS signal, video and/or audio degradation occurs over a very narrow region of carrier-to-noise plus interference, $C/(N+I)$, prior to complete loss of signal lock. Degradation in A/V quality originating from a digital broadcast is unlike that from an analog broadcast, where picture quality is very subjective. Instead, degradation is quite noticeable, and occurs in burst fashion when uncorrectable bit errors are presented to the Motion Picture Experts Group (MPEG) decoder. For low bit error rates, errors are corrected by the error correction coding inherent in the system. Video and audio impairments occur when the number of bit errors exceeds what is correctable by the concatenated code. Video impairments manifest as sudden pixelization in the image. Audio errors manifest as a sudden pop or chirp sound. In general, the rate of audio and video error occurrences increases as the $C/(N+I)$ ratio degrades. A video/audio quality criteria set was established for the purpose of assigning a quality measure. See Table A-1.

Table A-1. DBS A/V Quality Criteria

Assigned Quality Level (9=perfect)	Video/audio characteristics (average)
9	Perfect video/audio
8	1 video/audio error per 30 minutes
7	< 1 error per minute, but > than 1 per 30 minutes
6	< 1 error per 15 seconds, but > 1 error per minute
5	> 1 error per 15 seconds
4	Freeze framing and pixelization occurring; audio chirping and momentary blanking
3	Mostly pixelized, mostly frozen, mostly audio blanked
2	Occasional video acquisition, no audio
1	Loss of lock, no signal acquisition

A.3 Power Measurement for DBS, MVDDS, and Noise Signals

Evaluating the DBS system performance in the presence of MVDDS interference required that a consistent, repeatable measurement technique be used throughout the duration of the testing. The following sections describe the settings used for the measurement equipment as well as the rationale for choosing the measurement bandwidth.

A.3.1 Signal/Noise Power Measurements Using the Agilent 8564EC Spectrum Analyzer

Signal and noise power measurements are performed with an Agilent 8564EC spectrum analyzer. The analyzer settings used throughout the testing are given in Table A-2.

Table A-2. Spectrum Analyzer Settings

Resolution bandwidth	300 kHz
Video bandwidth	3 kHz
RF Attenuation	0 dB
Center frequency	Center of DBS video IF frequency
Span	30 MHz
Reference level	-20 dBm

A.3.1.1 Signal Power Measurements

Using the Agilent 8564EC spectrum analyzer, the power occupied bandwidth for the DBS video signal was performed at various percentages of the total power. While performing these measurements, the noise input is disabled. The results are presented Table A-3.

Table A-3. Power Occupied Bandwidth of DBS Signal

Percentage of Total DBS Signal Power	Occupied Bandwidth
50%	10 MHz
75%	15 MHz
90%	18.4 MHz
95%	20.0 MHz
96%	20.46 MHz
97%	21.04 MHz
98%	21.7 MHz
99%	22.7 MHz